

Sipuncula from the Indian Ocean and New Caledonia

by Edward B. CUTLER & Norma J. CUTLER

Abstract. — Collections of over 4200 sipunculans made by six different teams of French biologists from depths of 1-5340 m are assigned to thirty-four species. The diverse Indian Ocean locations were mostly around the Comoran Islands and the sub-Antarctic southern islands, plus a few from off Sri Lanka and French Polynesia. No new taxa are described, but eight have not been previously reported from the Indian Ocean (*Golfingia margaritacea*, *Nephasoma cutleri*, *Phascolion lucifugax*, *P. hybridum*, *P. tuberculosum*, *Onchnesoma magnibathum*, *O. squamatum*, *Apionsoma murinae bilobatae*). Most of these, as well as nine other range extensions, are based on deep or cold-water material.

Key-words. — Taxonomy, New Caledonia, Indian Ocean, Sipuncula.

Les Sipunculien de l'océan Indien et de Nouvelle-Calédonie

Résumé. — Les récoltes de plus de 4200 Sipunculien, réalisées par six équipes de biologistes français à des profondeurs de 1 à 5340 m, ont porté sur trente-quatre espèces. Les divers sites de l'océan Indien étaient le plus souvent situés autour des Comores et des îles du sud de la région sub-antarctique, et quelques-uns au large du Sri Lanka et de la Polynésie française. Aucun taxon nouveau n'a été décrit, mais huit étaient déjà connus de l'océan Indien.

Mots-clés. — Systématique, Nouvelle-Calédonie, océan Indien, Sipunculien.

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INTRODUCTION

While much has been written about the Indian Ocean sipunculan fauna, a good contemporary starting place is the comprehensive review presented at the 1970 International Symposium on the Biology of Sipuncula and Echiura (HALDAR 1975) in which 135 species were listed (not all currently considered valid). Since 1975, the report covering the widest geographic range (CUTLER & CUTLER 1979) was based on 4000 worms (fifty-four species) most collected during the International Indian Ocean Expedition of 1963-1964, plus others by B. Thomassin and associates, most coming from along the western part of the ocean. The three subsequent reports are more restricted to shallow water material. One on the Nicobar and Andaman islands (nine species) was offered by HALDAR (1976), while HALDAR's major work (1991) focused on the Indian coastal fauna (1900 specimens and 37 species). Most recently, SAIZ (1993) reported on an interesting collection, from the "MD-32 La Réunion" project, consisting of seventeen species, four new to the Indian Ocean.

Between 1972 and 1986, six groups of French biologists made collections of benthic invertebrates, including more than 4200 sipunculans, from some part of the Indian Ocean. Many of these expeditions were conducted on board the research vessel *Marion Dufresne*. Three collections were processed by the Centre National de Tri d'Océanographie Biologique (CENTOB) and made available by M. Segonzac. These were: Benthedi, from the northern Mozambique Channel (most near the Comoran Islands of Mayotte and Glorieuses) by the vessel *Suroit* in 1977; *Jasus* MD-50, from St Paul and Amsterdam Islands in 1986 under the direction of M. Arnaud, Marseille; and Safari I & II from south of Madagascar in 1979 and south-west of Sri Lanka in 1981. A series of three collections made by A. Guille, Paris, from the far southern islands came to us directly in part (Kerguelen Islands, 1972-1974) and partly via CENTOB. The latter were from MD-04 in 1975 from Kerguelen, MD-08 in 1976 from Marion (Prince Edward Islands), and Crozet Island. A collection from coral around Reunion was made by P. Delacroix, île de la Réunion, in 1980. The sixth contribution was made by B. Gout, Montpellier, from Mayotte Island in the Comorans in 1983 and 1986, and from New Caledonia, French Polynesia in 1985.

This new material covers a very wide variety of Indian Ocean habitats, at latitudes of 2-50°S, and longitudes of 38-87°E, from warm tropical sand and coral to cold sub-Antarctic mud, and from depths of 1-5340 m. The inclusion of the New Caledonia material from outside the Indian Ocean (166.5°E) was to avoid producing another small report on a set of nine species, when only two of these are not already in this report (*Aspidosiphon spiralis* and *A. laevis*).

None of the material represents new species but seventeen are zoogeographically interesting, eight new to the Indian Ocean (*Golfingia margaritacea*, *Nephasoma cutleri*, *Phascolion lucifugax*, *P. hybridum*, *P. tuberculosum*, *Onchnesoma magnibathum*, *O. squamatum*, *Apionsoma murinae bilobatae*), only one coming from shallow water (*P. lucifugax*). Nine species show significant range extensions (*Nephasoma constrictum*, *Phascolion convestitum*, *P. lutense*, *Onchnesoma steenstrupii*, *Phascolosoma noduliferum*, *Apionsoma murinae murinae*, *Aspidosiphon muelleri*, *A. spiralis*, *A. zinni*). All but one of these latter extensions were into deep or cold water in the Indian Ocean. The only warm shallow exception being *A. spiralis* to New Caledonia in the Pacific.

It is difficult to discuss a limited Indian Ocean fauna since the eastern boundary is so ill-defined. More commonly one considers an Indo-West Pacific fauna (CUTLER 1994). Also, this area from Southeast Asia through Indonesia, the Philippines, to Australia is so rich in species that inclusion of this boundary region would greatly inflate any species list. This brief consideration of the sipunculan fauna is primarily limited to that area west of the Ninetyeast Ridge (see Table 1). The exception to this is the fauna from New Caledonia included here for reasons mentioned above.

One common feature of these collections is the large number of small examples, *i.e.* trunks less than 7 mm long. This can represent adult size for a few of these taxa but not most. It seems clear that the methods used to collect, sort, and process the material have improved so that smaller representatives are not lost to science. This does make the task of identification more difficult and in several cases we could not, with certainty, apply specific names. Included in this report are thirty-four species from ten of the seventeen genera. Eight of the species are represented by more than 100 specimens, sixteen have from 10-100, while ten species have fewer than ten representatives in these collections.

In the following section the station data for each species will be summarized, but more precise data can be found in the Appendix. For a general treatment of this phylum including synonymies and illustrated keys to all taxa, see CUTLER 1994.

SYSTEMATIC SECTION

Family SIPUNCULIDAE Rafinesque, 1814

Genus SIPUNCULUS Linnaeus, 1766

Sipunculus nudus Linnaeus, 1766

The 134 worms were collected around the Comoran Islands (11.5-13°S, 45-47.5°E) at depths between 5-38 m (one station at 275 m).

Many are less than 10 mm long, and only a few reach a trunk length of 25 mm, none approaching the more common length of 50-150 mm. All are white, transparent, and with only twenty-three or twenty-four longitudinal muscle bands which is at the low end of the range for this species. Some of the very smallest appear to be recently settled larvae. Given the small size of this material it is possible that the distinctions between *S. nudus* and *S. robustus* are not yet developed (e.g. nephridial attachment and brain processes) so this identification is somewhat tenuous.

DISTRIBUTION

This has been collected from temperate, sub-tropical and tropical waters in all oceans. Most are from intertidal to 30 m, but a few records are from 100-900 m. Therefore, this material is not outside the known range.

Family GOLFINGIIDAE Stephen & Edmonds¹, 1972

Genus GOLFINGIA Lankester, 1885

Subgenus GOLFINGIA Lankester, 1885

Golfingia (Golfingia) margaritacea (Sars, 1851)

Sipunculus margaritaceus Sars, 1851. *Phascolosoma margaritaceum* Danielssen & Koren, 1877. *Golfingia margaritacea*; FISHER 1952; SAIZ 1995. *Golfingia margaritacea margaritacea*; CUTLER & CUTLER 1987; CUTLER 1994.

1. Dr. Stanley J. Edmonds, who contributed much to our knowledge about the biology of Sipuncula, died at age 86 in July, 1995.

Phascolosoma ohlini Theel, 1911. *Golfingia ohlini*; WESENBERG-LUND 1955. *Golfingia margaritacea ohlini*; CUTLER & CUTLER 1987; CUTLER 1994.

All 617 worms were collected from sub-Antarctic waters (46-50°S), 254 came from Marion (38°E, 95-204 m), thirty-six were collected near the Crozet Islands (49.5-50.5°E, 192-275 m), the remaining 327 came from around the Kerguelen Islands (68.5-70.5°E) at 17-230 m.

NOMENCLATORIAL NOTE

When CUTLER & CUTLER (1987) reviewed the genus *Golfingia* they retained two subspecies, but acknowledged the ill-defined nature of the boundary between the two taxa. This boundary was based partially on a non-overlapping range, but largely on two morphological differences: the presence/absence of introvert hooks and the shape of the posterior end of the trunk. SAIZ (1995) examined a large collection from the Weddell Sea ranging in length from 1.3-110 mm. He confirmed the deciduous nature of the hooks as those less than 24 mm carried hooks, but larger ones are hookless, and the end of the trunks graded from pointed to round. SAIZ concluded that the retention of subspecific rank can not be upheld and we here concur with his judgement.

The trunk length of this material ranged from 2-12 mm, but most are in the 3-7 mm range, quite small for this species. While both ends are opaque the body wall in the middle of the trunk is transparent. The introverts are 65-135% of the trunk length and may or may not bear small (30-45 µm) clear hooks. The pattern of presence/absence was less consistent than that reported above by SAIZ (1995) since even in these worms smaller than 10 mm, hooks are not always present. Most worm have eight to twelve small tentacles but one 3 mm worms exhibits sixteen. The posterior ends vary from round to pointed, a very small tail occasionally present. Sexual maturity seems to come early in this population since even in worms as small as 4 mm, gametes are present, eggs in some, sperm in others.

DISTRIBUTION

Widely distributed in the Atlantic, Arctic, and Antarctic oceans (80°N to 78°S), and less commonly in the northern and southern Pacific. They have been found at depths of 1-5300 m, but most come from less than 300 m. The deeper records are mostly at lower latitudes making this an example of tropical submergence, not bipolar distribution. The species was unknown from the Mediterranean Sea, and the Indian Ocean *per se*.

While this species has been reported from Indian Ocean longitudes, the southern latitudes have been in the 66-67° range (STEPHEN 1948 as *G. mawsoni*). Therefore, while the border between the Antarctic and the Indian Oceans is not precise, the Southwest Indian Ridge can serve as that limit. These current records are the first in this part of the world, from north of the 50th parallel, *i.e.* the Southwest Ridge. Thus, this is a new record for the Indian Ocean.

***Golfingia* (*Golfingia*) *muricaudata* (Southern, 1913)**

These eighty worms came from five areas: eighteen worms near Mayotte (11.5-13°S, 45-47.5°E) at depths of 325-3716 m, two worms from south of Sri Lanka (5.5°S, 78.5°E) at

3660 m, and nine worms near Amsterdam and St Paul Islands (38-39°S, 77-78°E) at 315-1685 m. From further south, there are eleven worms from Marion Island (47°S, 38°E) at 204 m, and forty worms off the Kerguelens (49°S, 67-69.5°E) at 230-315 m.

The trunks are 2-35 mm long (most under 15 mm) and exhibit the distinctive posterior papillae and tail (0.5-4 mm) characteristic for this species. The small deciduous hooks may be present (in smaller) or absent (in larger worms). The body walls are transparent to translucent in the under 15 mm animals, becoming opaque and coarse in larger worms.

DISTRIBUTION

Common in deep water from the North Atlantic, and it occurs off South Africa and Bouvet Island. It is known from the northern and southern Pacific. In the Indian Ocean it has been reported from the east coast of Africa at bathyal depths, but previously unknown from the rest of the Indian Ocean. Therefore, the Sri Lanka and sub-Antarctic specimens represent a significant extension of this taxon and suggest a low density, cosmopolitan, cold water distribution.

Subgenus *SPINATA* Cutler & Cutler, 1987

Golfingia (Spinata) pectinatoides Cutler & Cutler, 1979

The three worms came from off Glorieuses (11.5°S, 47.5°E), at 24 m.

These worms having rings of unidentate hooks with basal spinelets, bilobed nephridia, but lacking a posteriorly attached spindle muscle and longitudinal muscle bands, clearly belong to this taxon.

DISTRIBUTION

Previously known from southern Madagascar and French Polynesia at intertidal depths. This new material represents only a small northward extension of its western Indian Ocean range.

Genus *NEPHASOMA* Pergament, 1940

Nephasoma constrictum (Southern, 1913)

Eight of these worms came from near Mayotte (13°N, 45°E), at 350 m. The other nine were collected around Sri Lanka (2-8°S, 79-87°E) between 1095-4350 m.

The plump spindle-shaped trunks range from 3-40 mm long with introverts about 50-75% of the trunk length. The peculiar neck-like constriction at the base of the introvert and large, dark, dome-shaped papillae characterize this species. The hooks appear to be deciduous so that smaller worms tend to have more than larger worms. Internally the nephridia open a little behind the anus and the retractor muscles originate in the middle of the trunk. Two worms had been living in polychaete tubes and several had remnants of a grey mud coating.

DISTRIBUTION

In the northeastern Atlantic Ocean and western Mediterranean (34-51°N) at 150-4000 m. A recent find by SAIZ (1993) from Réunion at 75-750 m (plus a few to 3500 m) was the first for the Indian Ocean. Therefore, these records reinforce and extend its range northward and eastward in the colder water of the Indian Ocean.

Nephasoma cutleri (Murina, 1975)

Most of these thirty-nine worms were collected off Marion Island (47°S, 38°E) at 95-204 m. The remaining four worms lived further northeast near Sri Lanka (5.5°S, 78.5°E) at 3660 m.

They are thread-like animals, the largest being 6 mm long, with introverts 50-75% of the trunk length. This introvert length helps distinguish it from the similar *N. constricticervix* that has a much shorter introvert. The pair of very short nephridia and medium-large hooks (50-150 µm) are typical for this species.

DISTRIBUTION

Scattered Pacific Ocean reports from 80°S to 11°N, at depths between 2600-4600 m. Therefore, this report is the first for the Indian Ocean and a significant extension of its longitudinal and bathymetric range.

Nephasoma diaphanes diaphanes (Gerould, 1913)

Of these 561 worms, 382 came from around the Comoran Islands (11.5-13°N, 45-47.5°E) at 250-1390 m. Eight worms came from off Sri Lanka (1.5-6°S, 78.5-87°E) at depths of 3660-5175 m (the only species from over 4500 m in these collections), and thirty-five were collected near St Paul and Amsterdam Islands (37.5-39°S, 77.5°E) between 262-2200 m. From the sub-Antarctic islands there are seventy-six worms from Marion Island (47°S, 38°E) at 31-192 m, forty-nine worms from the Crozet Islands (46-47°S, 49.5-51.5°E) at 143-1230 m, and eleven from the Kerguelen Islands (49-50°S, 68.5-70.5°E) at 43-195 m.

The present material may contain some animals that might be called *N. abyssorum* (with smooth white skin) or *N. diaphanes corrugatum* (with rough brown skin), if they are in better condition. A few of the worms from the far southern waters had been living in arenaceous foraminiferan tests and exhibited larger dome-shaped dark papillae. These have slender, straight trunks 2-12 mm long (most less than 5 mm) that are often transparent. The introvert bears scattered, small, bluntly pointed hooks and a few tentacular lobes.

DISTRIBUTION

Cosmopolitan in cold water, most from bathyal and abyssal depths (down to 5300 m). These new data reinforce its presence in the Indian and sub-Antarctic oceans.

Family PHASCOLIONIDAE Cutler & Gibbs, 1985

Genus PHASCOLION Théel, 1875

Subgenus ISOMYA Cutler & Cutler, 1985

Phascolion (Isomya) convestitum Sluiter, 1902

Seven of these eight worms were collected off New Caledonia (22.5°S, 166.5°E) at 10-28 m, while a single worm came from Mayotte Island (12.5°S, 45°E) at 27 m. All had been living in a shelter such as an empty gastropod shell.

Since some of these are badly damaged and the trunks are only 1.5-4 mm long, we have some reservations about this identification. Nevertheless, we place these here given the equal size of the retractor muscles, the broad-based, recurved, 40-60 µm, Type II *Phascolion* hooks (fig. 30E in CUTLER 1994), and the weakly developed holdfast papillae. The papillae around the anterior end of the trunk are large and crowded, thus, except for the smaller hook size, they strongly resembles *P. tuberculosum*.

DISTRIBUTION

Mediterranean, Red Sea, Gulf of Aden and Indonesia, from 25-275 m. New reports by SAIZ from the Weddell Sea (74.5°S, 30°W) at 600-700 m indicate the presence of this species in the southern seas. Therefore, this material extends the known range further south in the Indian, and further east into the Pacific Ocean.

Phascolion (Isomya) lucifugax Selenka & de Man, 1883

All four worms came from Mayotte Island (12.5°S, 45-46.5°E) at 5-25 m, and had been living in empty gastropod shells.

This uncommon species has blunt Type III hooks (fig. 30I in CUTLER 1994) and no obvious holdfast papillae. Another diagnostic feature is the numerous tentacles, usually more than thirty. The anterior trunk papillae are dome-shaped and crowded, but otherwise the trunk appears smooth. The two equal sized retractor muscles originate very close to the posterior end. The intestine does not form coils but has irregular loops only.

DISTRIBUTION

Philippines and northern Japan at unknown depths, probably less than 100 m. This material is the first record from the Indian Ocean thus a significant range extension.

Phascolion (Isomya) tuberculosum Théel, 1875

The forty-six specimens were collected from three regions: thirty-nine came from Glorieuses (11.5-13°S, 45-47.5°E) at 23-440 m; two from St Paul and Amsterdam Islands (38-39°S, 77.5°E) at 262-315 m; five worms from New Caledonia (22.5°S, 166.5°E) at 22 m.

The two equal sized retractor muscles place these worms in this subgenus. Despite their very small size (1-2 mm) most do show the large, recurved, dark, Type II hooks (Fig. 30F in CUTLER 1994). Pale, round holdfast papillae resembling thick crepes that characterize this species are present on many, but others show only large bulbous papillae, some are almost smooth, and a few of the smallest still carry the larval array of numerous, very small papillae. When tentacles are visible there are 10-12 short ones serving to differentiate this from *P. lucifugax*. Most trunks are white to transparent and the gut is without regular coils.

DISTRIBUTION

Common in the northeastern Atlantic at depths of 25-2700 m. The few specimens from Japan and New Zealand from 93-300 m suggest a low-density population in the Pacific, a pattern reinforced by this New Caledonia record. This new material also represents the first records from the Indian Ocean, a significant extension.

Subgenus MONTUGA, Gibbs, 1985

Phascolion (Montuga) lutense Selenka, 1885

While one of these twenty-eight worms was found southeast of Madagascar (32°S, 48.5°E) at 3825 m, most came from the area around St Paul and Amsterdam Islands (37.5-38.5°S, 77.5°E) at 975-2200 m.

The smooth, almost transparent skin and the distinctive grey "cap" at the anterior end of the trunk is typical for this species. They create soft cocoon-like mud tubes and, this collection, are 2-9 mm long. Internally the esophagus leaves the retractor column prior to its subdivision, and the gut does form into coils.

DISTRIBUTION

Generally a cold-water species (1800-6860 m) that appears to be absent in the lower latitudes. In the southern Hemisphere it has been found in the Pacific Ocean between 36-66°S, and from 20-32°S in the Atlantic. In the Indian Ocean the only prior record is from the southern end of the Mozambique Channel (32.5°S, 13°E). In the northern Hemisphere it is known from the northwestern Pacific and the northeastern Atlantic, 47-56°N. Therefore, this material reinforces its presence in the southern Indian Ocean with a significant eastward extension.

Subgenus PHASCOLION Théel, 1875

Phascolion (Phascolion) hibridum Murina, 1981

These forty-five worms were collected near St Paul and Amsterdam Islands (38-39°S, 77.5°E) at 262-975 m.

These worms, that had been living in empty gastropod and scaphopod shells, are up to 10 mm long. They have distinct dark hooks, but lack holdfasts and regular gut coils. The small tentacles are well-formed and the anterior end of the trunk is surrounded by an aggregation of tall, pointed, dark papillae giving the impression of a shield. The single (fused) large dorsal retractor muscle originates near the posterior end of the trunk.

DISTRIBUTION

Malaysia and Samoa at 1500-2380 m. These worms constitute not only a significant westward extension of the known range, but also the first Indian Ocean record. The water depth is somewhat shallower but, due to the latitude, the temperature is still cold.

Phascolion (Phascolion) strombus strombus (Montagu, 1804)

326 of these 332 worms were living around the Comoran Islands (mostly from Mayotte, 11.5-13°S, 46-47.5°E) at 250-1390 m, in discarded gastropod shells. The remaining six were collected off the Kerguelen Islands (47-49.5°S, 70-71.5°E) at 31-1390 m.

While the holdfast papillae of this most common *Phascolion* are variable, most are U-shaped with pointed, thin, hardened borders. Some are rounded with the hardened protein distributed over much of its dome-like surface, reminding one of *P. tridens* but with only a single point. Since these are small worms their body walls are largely transparent. Around the anterior trunk are large, mammiform, dark reddish papillae. Type I hooks (fig. 30A in CUTLER 1994) and fewer than 20 tentacles are present. The two retractor muscles are of very different dimensions and the gut is arranged in loops.

DISTRIBUTION

Very common and eurytopic in the North Atlantic and Arctic Oceans. There are scattered records from the Caribbean, Mediterranean, and Red Sea, the Gulf of Aden, southwest Indian Ocean, Argentina, and Chile. Other records exist from the far South Pacific, and off Japan. It is known from depths of 1-4030 m, most commonly between 50-2000 m. These new worms confirm the presence of this taxon in the western and far southern Indian Ocean.

Genus **ONCHNESOMA** Koren & Danielssen, 1875

Onchnesoma magnibathum Cutler, 1969

Both worms came from very deep water, one from east of Madagascar (32°S, 48.5°E) at 3825 m, and the other from southwest of Sri Lanka (1.5°S, 87°E) at 4420 m.

The characteristic posterior radiating folds of skin or "keels", and a trunk lacking papillae that tapers into the introvert are distinctive in these specimens.

DISTRIBUTION

Widespread in the Atlantic Ocean with one record from the southeastern Pacific. Generally from depths between 3000-5500 m. This report constitutes the first from the Indian Ocean.

Onchnesoma squamatum (Koren & Danielssen, 1875)

These twelve worms came from one station off Mayotte (12.5°S, 45°E) at 325 m.

The spherical trunks are 2-5 mm long and mostly covered with closely packed large gray papillae. A few worms have smooth patches where these papillae were no longer present.

DISTRIBUTION

Known from the northern Atlantic (commonly 150-1400 m, a few down to 2300 m), and Mediterranean Sea (shallow water, 10-55 m). Thus, these worms are another first record from the Indian Ocean.

Onchnesoma steenstrupii Koren & Danielssen, 1875

The 145 worms were collected near Mayotte (12.5-13°S, 45°E) at 235-815 m.

The spherical trunks are 2-5 mm long and have a series of keels radiating out from the posterior tip composed of tiny plate-like papillae. The introvert is several times the length of the trunk and internally it appears to have a single retractor muscle originating very near the posterior end.

DISTRIBUTION

Found in much of the Atlantic Ocean, (23°S to 57°N), and in the higher latitudes of the western Pacific, and the southwestern Indian Oceans (35°S, 22.5°E). In general it inhabits waters at bathyal depths on continental slopes (100-1600 m, rarely 40-3000 m). So this new material extends the range further up into the western Indian Ocean.

Family PHASCOLOSOMATIDAE Stephen & Edmonds, 1972

Genus PHASCOLOSOMA Leuckart, 1828

Phascolosoma nigrescens (Kefferstein, 1865)

The fifteen worms were present in three collections at depths of 1-30 m: nine came from Réunion (21.5°S, 56°E), five from the Comoran Islands (12.5-13°S, 45.5-46.5°E), and one from New Caledonia (22.5°S, 166.5°E).

These 4-30 mm worms have body walls that vary from almost transparent in the smallest, to a uniform pale brown color. One significant attribute is the many rings of hooks (more than fifty) that have a distinctive internal structure. Often the rings extend to near the base of the

introvert, which is longer than the trunk. The unremarkable trunk papillae are of uniform size and of the same color as the skin.

DISTRIBUTION

Very widespread circumtropical species; generally between 30°N and 30°S, in shallow waters of the world's oceans. Thus, this material fills in within the known range.

***Phascolosoma noduliferum* Stimpson, 1855**

These eleven worms came from near the St Paul and Amsterdam Islands (38°S, 77.5°E) at depths of 75-90 m.

The trunks are only 3-5 mm long making them difficult to identify with confidence. They do have large papillae with the distinctive platelets, and the hooks are in many rings varying somewhat in detail. They are referred to this species with some hesitation.

DISTRIBUTION

Intertidal from southern Australia and Tasmania, plus deeper water off the Philippines, New Guinea and New Zealand. This record is, therefore, a major westward extension into the southern Indian Ocean.

***Phascolosoma scolops* (Selenka & de Man, 1883)**

Most of these worms (24/29) were collected on Réunion (21.5°S, 56°E) from intertidal depths, while the remaining five came from the Comoran Islands (11.5-12.5°S, 46-47.5°E) at 25 m.

The trunk lengths are from 3-21 mm, most less than 10 mm and most are white with darker red dome to cone-shaped papillae that are larger and more concentrated at each end. A few of the very smallest appear to be recently settled juveniles. The long introvert has dark patches along its dorsal surface and fewer than twenty-five rings of hooks.

DISTRIBUTION

Common throughout the Indo-West Pacific, including northern Japan, south to northern Australia, and east to Hawaii. Usually found at intertidal and shallow depths (< 30 m). Recently reported from Reunion at 1-10 m (SAIZ 1993). Some reports from off western Africa exist but these may be misidentified *P. stephensoni*. This material fits into the known range.

***Phascolosoma stephensoni* (Stephen, 1942)**

The two worms came from the intertidal zone of Réunion (21.5°S, 56°E).

Neither of these worms were complete being represented by the anterior portion only. The identification is based on the unique hooks with both a clear streak and crescent, and the cone-shaped preanal papillae that are smooth and red.

DISTRIBUTION

In the Mediterranean Sea, eastern Atlantic from the Azores south, western and northwestern Indian Ocean (Durban, Mozambique, Somalia, southwestern India), and western Pacific. These Reunion collections are a small extension of the known range into the central Indian Ocean.

Genus **ANTILLESOMA** (Stephen & Edmonds, 1972)

Antillesoma antillarum (Grube & Oersted, 1858)

Five of these six worms lived on Réunion (21.5°S, 56°E) in intertidal water, and the sixth was collected off Mayotte (12.5°S, 45.5°E) at 8 m.

These worms are small for this species being only 4-6 mm long. Nevertheless, they do exhibit the large dark papillae over most of the body, a short introvert with no hooks, bushy tentacles, and many contractile vessel villi that characterize this species.

DISTRIBUTION

This is a cosmopolitan species found in tropical and subtropical, intertidal and shallow waters, including many locations in the Indian Ocean. The most recent report is also from Réunion (SAIZ 1993), so this new material only reinforces our prior knowledge.

Genus **APIONSOMA** Sluiter, 1902

Apionsoma misakianum (Ikeda, 1904)

Most of these 192 worms were collected off New Caledonia (22.5°S, 166.5°E) at 8-28 m, fifty-four came from the Comoran Islands (11.5-13°S, 45-47.5°E) at 15-38 m, and four had been living on Réunion (21.5°S, 56°E) between 1-15 m.

The slender, 2-10 mm, spindle-shaped worms have very long thin introverts bearing rings of hooks near the tip. The round posterior papillae help distinguish this from the hookless but similar *A. trichocephala*, both having four slender retractor muscles and bilobed nephridia. The small hooks have the comb-like array of basal spinelets.

DISTRIBUTION

Widespread but not common in shallow tropical and subtropical waters of the Indian (East Africa, Madagascar, western India, western Australia), Pacific, and western Atlantic oceans. Most recently SAIZ (1993) has reported this from Réunion at 58-77 m, so these new specimens merely confirm its presences in the Indo-West Pacific.

***Apionsoma murinae murinae* (Cutler, 1969)**

The waters around the Comoran Islands yielded twenty-six of these forty-three worms (11.5-13°S, 45-47.5°E) at 250-1125 m. Another sixteen came from near St Paul and Amsterdam Islands (38-38.5°S, 77.5°E) at 1430-2200 m, and the deepest specimen was collected south of Sri Lanka (5.5°S, 78.5°E) at 3600 m.

The large mammiform papillae on the posterior quarter of these plump, spindle-shaped, 2-10 mm worms with single lobed nephridia, are characteristic. Internally the four very thin retractor muscles originate close to the ventral nerve cord.

DISTRIBUTION

Widespread in the northern Atlantic, down to 15°S on the eastern side at 1000-5200 m. In the Pacific it has been reported in the Bering Sea and in deep waters of the southern Pacific. It is also known from both sides of the Indian Ocean (Kenya, Philippines, Indonesia, at 300-600 m).

These Indian Ocean records are from CUTLER (1977), but have been mistakenly credited to *A. murinae bilobatae* in subsequent works including CUTLER 1994. So while this new material nicely fills in large gaps within the Indian Ocean, it is not new for the ocean. This does complete the circle showing this to be well established around the globe.

***Apionsoma murinae bilobatae* (Cutler, 1969)**

Two samples yielded sixty-eight worms from Mayotte (13°S, 45.5°E) at 350-625 m.

The presence of a short second lobe on the nephridia (10-40% of the primary lobe), and a flask-shaped trunk with pale thin walls and rounded posterior end differentiate this taxon from the nominate form.

DISTRIBUTION

A northern Atlantic subspecies that is more restricted than the nominate form (300-1900 m). In the Mediterranean it has been found at 160-1230 m. Earlier attributions of this taxon from the Indian Ocean were errors, see *A. murinae murinae*. Therefore, this is the first record from the Indian Ocean and a significant extension of its known range.

***Apionsoma trichocephalus* Sluiter, 1902**

Most of the 286 worms came from the Comoran Islands (12.5-13°S, 45-46.5°E) at 2-32 m. The remaining forty-three were collected off New Caledonia (22.5°S, 166.5°E) at 8-22 m.

This small (2-10 mm) slender, spindle-shaped, sand-dwelling worm is the only member of this genus lacking hooks on the thin introvert that is 6-8 times the length of the trunk. Tentacles also appear to be lacking. The trunk is smoother than the similar hook-bearing *A. misakianum*

with inconspicuous papillae. Several of the worms from Mayotte, even those with trunks only 5 mm long, are carrying large eggs.

DISTRIBUTION

Southeastern United States and Gulf of Mexico, West and South Africa, around the western and northern margins of the Indian Ocean, Vietnam, Japan, Indonesia, Australia, New Zealand, and Costa Rica (unknown from the central Pacific). Found at intertidal depths to 100 m. These new collections reaffirms its presence in the western Indian Ocean while the New Caledonia records complement other Pacific Ocean reports.

Family ASPIDOSIPHONIDAE Baird, 1868

Genus ASPIDOSIPHON Diesing, 1851

Sub-genus ASPIDOSIPHON s. str.

Aspidosiphon (Aspidosiphon) elegans (Chamisso & Eysenhardt, 1821)

All twenty-seven specimens were collected from intertidal water on Réunion (21.5°S, 56°E).

While several of the worms are damaged or incomplete, trunk lengths are from 2.5-20 mm, but most are less than 10 mm long with almost transparent skin. The ungrooved, uniformly granular anal shields are golden in color. Hooks of two types are present. The Type A, compressed, recurved, bidentate hooks in rings, and the Type C, conical, scattered hooks on the dorsal side of the introvert that are less dark in the smaller worms (figs 55A & 62A in CUTLER 1994).

DISTRIBUTION

Widespread and common in the Indian and western Pacific oceans to Hawaii, and in the Caribbean. Lives in dead coral and soft rock in shallow waters. These new records reinforce their presence in the central Indian Ocean.

Aspidosiphon (Aspidosiphon) gracilis gracilis (Baird, 1868)

Three of these six worms were taken from Mayotte (12.5°S, 45°E) at 2-25 m, and the others came from New Caledonia (22.5°S, 166.5°E) at 16 m.

Partially due to their small size (2-8 mm trunks) these worms are referred here with some reservation. The distinguishing attributes are the weakly developed ungrooved anal shield and the presence of only unidentate hooks. One 6 mm specimen died with the introvert fully extended showing six short lobes for nuchal tentacles.

DISTRIBUTION

The northern and eastern Indian Ocean to the Philippines, generally in intertidal coral rock. Therefore, this questionable material extends the range southward on the western side and a little further into the western Pacific Ocean.

Aspidosiphon (Aspidosiphon) muelleri Diesing, 1851

This is by far the most commonly encountered species in these collections coming from four areas: the Comoran Islands yielded 1346 worms (11.5-13°S, 45-47.5°E) at 5-705 m, four worms were collected near the Kerguelens (49.5°S, 70°E) at 31 m, seven worms were found off St Paul and Amsterdam Islands (38.5°S, 77.5°E) at 135-575 m, and forty-four came from New Caledonia (22.5°S, 166.5°E) at 10-28 m. About 1300 of the 1400 specimens were collected from depths greater than 250 m. Most had been living in gastropod and some in scaphopod shells while at least a few had been living in coral rock.

Most of these worms are transparent or white and 1-4 mm long. Some are 5-10 mm long, only a few are in the 10-25 mm range. The smallest worms, around 1 mm long, still exhibit larval papillae and are clearly recently settled juveniles. Since most of these worms are less than 5 mm they have just the beginning of grooves and patches of hardened protein on their shields. The smallest have only light brown dots of denser material, with intermediate forms, from pale to the typical heavy dark shields in those over 15 mm long. The small array of cone-shaped spines along the ventral margin of the anal shield was present in some of the larger worms but not evident on most of those under 5 mm long. Those with undeveloped shields can look very similar to some *Phascolion* species. Only unidentate compressed hooks are present, and in a few specimens scattered hooks existed along the whole introvert. Eggs were present in worms as small as 4 and 6 mm.

DISTRIBUTION

Common in the northeastern Atlantic (48-10°N), through the Mediterranean and Red seas, and along the east coast of Africa to Madagascar and South Africa. Sri Lanka and Indonesia are the other Indian Ocean records. There are reports from the western margin of the Pacific from Japan through southeast Asia to Australia and the Kermadec Islands. It seems to be absent from most of the Pacific Ocean; one record near Chile. In the western Atlantic only one record from southern Brazil is known. Often found at depths of 5-400 m, occasionally as deep as 1000 m and rarely as deep as 2900 m. Most often found in discarded gastropod or scaphopod shells. Some from shallow, warm water live in the bases of solitary corals (previously known as *A. corallicola* or *A. jukesii*). Thus, while this Comoran material is not surprising, the few from the far southern islands constitute an extension into that part of this ocean and the New Caledonia worms constitute a small extension into the Pacific.

Aspidosiphon (Aspidosiphon) spiralis Sluiter, 1902

These twenty-five worms all came from New Caledonia (22.5°S, 166.5°E) at 13-22 m, and had been living in gastropod shells.

This rare species was originally based on only four worms and the 4-7 mm animals we have are much smaller than the 40 mm type specimen. Ours differ in a few ways. The main factor pointing to this species (and differentiating it from the similar *A. muelleri*) is the ungrooved anal shield that is made up of irregular squares and dark patches that spread past the anus and over the anterior end of the trunk. The anterior ventral edge shows a few small cone-shaped

spines on some worms. Rings of hooks, present in the type, could not be located in this material. We found only scattered Type B, pyramidal hooks (15-30 μm) that are dispersed over most of the introvert.

DISTRIBUTION

Indonesia, in gastropod shells, at 10-90 m. Thus, this new material, if real, extends its range a small distance into the western Pacific Ocean.

Sub-genus **PARASPIDOSIPHON** (Stephen, 1964)

Aspidosiphon (Paraspidosiphon) laevis de Quatrefages, 1865

The four specimens were collected off New Caledonia (22.5°S, 166.5°E) at 11-12 m.

Distinct longitudinal muscle bands can be seen through the body wall in these 8-20 mm worms. Unidentate Type A hooks are arranged in rings, and the dark anal shield is grooved. The anterior end of the spindle muscle does branch with the larger strand going to the body wall posterior to the anus, and the other part continuing anteriorly as in most species. The retractor muscles originate in the third quarter of the trunk, not near the posterior end as in the similar *A. coyi*.

DISTRIBUTION

Widespread, but low density, in warm waters in the Indo-West Pacific east to Hawaii. Also present in warm water on both sides of the Atlantic. Inhabits shallow-water coral rock. This new material fits into the known range.

Aspidosiphon (Paraspidosiphon) steenstrupii Diesing, 1859

Twelve of these thirteen worms were collected from Réunion (21.5°S, 56°E) at 1-20 m, while a single specimen was found off Mayotte (12.5°S, 45.5°E) at 20 m.

Many of these have trunks measuring 20-27 mm, but a few are in the 5-10 mm range. Some worms have been damaged and are without a posterior end. The longitudinal muscle bands can be seen through the body wall, better developed in the larger worms, and the ungrooved, granular anal shields are of the creamy white variety. The skin at the anterior end of the larger worms has a rough "corky" appearance.

DISTRIBUTION

Throughout the western and northern Indian Ocean and the western Pacific islands to Hawaii. Also collected from the Caribbean, Cape Verde Islands, and the Gulf of Guinea. It lives in shallow-water coral rocks. This new material does not expand its known range.

Sub-genus **AKRIKOS** Cutler & Cutler, 1989

Aspidosiphon (Akrikos) thomassini Cutler & Cutler, 1979

All but three of these seventeen worms came from Mayotte (12.5°S, 45°E) at 2-3 m (one station at the unusual depth of 340 m), the other three were taken at New Caledonia (22.5°S, 166.5°E) at 19 m.

The external morphology of this species is one of the least "aspidosiphonid" in this genus, sometimes looking more like a *Nephasoma* species. It has a very weakly developed anal shield, no caudal shield, and an introvert that is 3-4 times the trunk length coming off at much less than a right angle to the trunk. Hooks are not present, and one worm has its introvert fully extended showing previously unseen tentacular lobes. The anterior of these 2-12 mm trunks do have dispersed papillae and a rough or reticulated appearance. The two thin retractor muscles originate at, or very near, the posterior end.

DISTRIBUTION

Madagascar and French Polynesia, in intertidal coral sands. This new material is from the same or very close to previously known locations. The deeper records are of interest.

Aspidosiphon (Akrikos) zinni¹ Cutler, 1969

The four worms came from one station near St Paul and Amsterdam Islands (34.5°S, 77.5°E) at 2200 m.

While this species rarely exceeds 5 mm, the largest worm in this collection is 4 mm long. They are transparent, very thin, and have the characteristic golden-brown, fine-grained, flat anal shield with distinct borders.

DISTRIBUTION

Common in the northern Atlantic Ocean at depths of 1100-4400 m, plus two records from off the Congo River and two from the Indian Ocean (Mozambique Channel and Reunion at 45-1425 m). Often lives in arenaceous foraminiferan tests. This material does extend its range further into the southern Indian Ocean.

Genus **CLOEOSIPHON** Grube, 1868

Cloeosiphon aspergillus (de Quatrefages, 1865)

All six worms were collected on Réunion (21.5°S, 56°E) at 1-30 m.

1. Prof. Donald J. Zinn, for whom this species was named, died at age 85 in September, 1996.

TABLE 1. — Sipunculan species in this report with Indian Ocean literature records. Regions: We - western (Africa, Madagascar, Comoran), No - northern (Arabian Sea, India, Sri Lanka), Ce - central (ocean and islands far from large land masses), So - southern (south of 35°S., sub-Antarctic), () = material in this report; s = shallow, 0-50; m = mid-depths, 50-500; d = deep, > 500 m; # = New Caledonia species, < 30 m. Reference numbers relate to numbered items in References.

	REGIONS				REFERENCES
	We	No	Ce	So	
Family SIPUNCULIDAE					
Genus SIPUNCULUS					
<i>S. nudus</i>	s(s)	s	-	-	8, 13, 15, 19, 23, 24, 39, 51, 54
Family GOLFINGIIDAE					
Genus GOLFINGIA					
<i>G. margaritacea</i>	sm	-	-	sm(sm)	34, 43, 50, 58
<i>G. mundaudata</i>	d(d)	-(d)	-	d(md)	8, 16, 17
<i>G. (Spinata) pectinatoides</i>	s(s)	-	-	-	8
Genus NEPHASOMA					
<i>N. constrictum</i>	-(d)	-(d)	md	-	41
<i>N. cutleri</i>	-	-(d)	-	-(m)	new
<i>N. diaphanes</i>	m(d)	-(d)	md	-(md)	8, 41, 58
Family PHASCOLIONIDAE					
Genus PHASCOLION					
<i>P. hibridum</i>	-	-	-	-(d)	new
<i>P. strombus</i>	sm(d)	sm	-	-(md)	8, 9, 18, 32, 33, 52, 58
<i>P. (Isomya) convestitum</i> #	m(s)	m	-	-	8, 33
<i>P. (Isomya) lucifugax</i>	-(s)	-	-	-	new
<i>P. (Isomya) tuberculosum</i> #	-(m)	-	-	-(m)	new
<i>P. (Montuga) lutense</i>	-	-	-(d)	-(d)	new
Genus ONCHNESOMA					
<i>O. magnibathum</i>	-	-(d)	-(d)	-	new
<i>O. squamatum</i>	-(d)	-	-	-	new
<i>O. steenstrupii</i>	m(d)	-	-	-	52
Family PHASCOLOSOMATIDAE					
Genus PHASCOLOSOMA					
<i>P. nigrescens</i> #	s(s)	s	s(s)	-	1, 3, 8, 11, 14, 17, 23, 24, 25, 30, 31, 33, 35, 37, 40, 41, 45, 56, 58
<i>P. noduliferum</i>	-	-	-	-(m)	new
<i>P. scolops</i>	s(s)	s	s(s)	-	3, 5, 8, 12, 23, 24, 25, 27, 30, 41, 45, 46, 49, 52, 54, 58
<i>P. stephensoni</i>	s	s	-(s)	-	24, 37, 49, 58
Genus ANTILLESOMA					
<i>A. antillarum</i>	s(s)	s	s(s)	-	8, 13, 24, 25, 31, 41, 44, 45, 46, 58
Genus APIONSOMA					
<i>A. misakianum</i> #	sm(s)	s	md(s)	-	8, 24, 41, 57, 58

	REGIONS				REFERENCES
	We	No	Ce	So	
<i>A. murinae murinae</i>	-(d)	-	-(d)	-(d)	new
<i>A. murinae bilobatae</i>	d(d)	-	-	-	5
<i>A. trichocephalus</i> #	s(s)	s	-	-	8, 24, 33, 52
Family ASPIDOSIPHONIDAE					
Genus ASPIDOSIPHON					
<i>A. elegans</i>	s	s	-(s)	-	6, 22, 24, 29, 30, 56
<i>A. gracilis</i> #	-(s)	s	-	-	24, 26
<i>A. muelleni</i> #	s(sd)	sm	md	-(sd)	2, 3, 8, 33, 41, 46, 54, 56
<i>A. spratti</i> #	-	s	d	-	41, 46
<i>A. (Akrikos) thomassini</i> #	s(s)	-	-	-	8
<i>A. (Akrikos) zinni</i>	m	-	md	-(d)	8, 41
<i>A. (Paraspidosiphon) laevis</i> #	s	s	-	-	8, 12, 23, 24
<i>A. (Paraspidosiphon) steenstrupi</i>	s(s)	sm	sm(s)	-	5, 8, 23, 24, 29, 37, 45, 49, 54
Genus CLOEOSIPHON					
<i>C. aspergillus</i>	s	s	s(s)	-	3, 8, 12, 13, 24, 30, 40, 41, 45, 46, 54

This is probably the easiest sipunculid to identify with its distinctive white cone-shaped anal shield made up of closely set diamond-shaped units with the introvert protruding through its center along the main trunk axis.

DISTRIBUTION

Widespread in the Indo-West Pacific stopping west of Hawaii. Lives in coral rock. The most recent record is also from Réunion (SAIZ 1993) so this material does not add to the known range.

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Numbers relate to numbers in Table 1.

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APPENDIX — STATION DATA

Genera and species arranged alphabetically. Within species, stations arranged by longitude from West to East. Source code: 42 = Guille, 50 = Dellacroix, 52 = SAFARI, 55 = BENTHEDI, 75 = JASUS, 77 = Gout.

LATIT LONGIT DEPTH NUMB SOURC YR STATION
(S) (E) (M) IND.

Antillesoma antillarum

1245	04517	0008	1	55	77	R16
2130	05610	0030	1	50	80	49
2130	05610	0001	1	50	80	201
2130	05610	0001	2	50	80	202
2130	05610	0001	1	50	80	3

Apionsoma misakianum

1233	04456	0025	1	55	77	S79
1254	04456	0015	2	55	77	S51
1242	04459	0038	3	55	77	S65
1304	04509	0033	5	55	77	S46
1243	04510	0002	7	77	86	1R
1242	04510	0007	2	77	86	8C
1247	04512	0018	1	77	83	61
1247	04512	0018	1	77	83	62
1247	04512	0019	1	77	83	53
1247	04512	0023	1	77	83	G1
1247	04512	0018	2	77	86	82
1254	04516	0340	24	55	77	S33
1252	04516	0030	5	55	77	S36
1225	04616	0020	1	55	77	R106
1222	04628	0013	4	55	77	S116
1125	04719	0026	6	55	77	DS103
1132	04723	0024	3	55	77	S124
2130	05610	0015	1	50	80	103
2130	05610	0001	1	50	80	202
2130	05610	0001	2	50	80	212
2220	16630	0026	1	77	85	3
2220	16630	0014	5	77	85	8B
2220	16630	0014	4	77	85	9C
2220	16630	0009	1	77	85	20B
2220	16630	0012	14	77	85	28A
2220	16630	0008	1	77	85	47C
2220	16630	0010	36	77	85	48B
2220	16630	0010	4	77	85	48C
2220	16630	0011	22	77	85	63B
2220	16630	0022	7	77	85	67A
2220	16630	0022	24	77	85	67B

Apionsoma murinae murinae

1254	04454	0750	1	55	77	D552
1248	04457	0700	6	55	77	D558
1241	04457	0815	13	55	77	D564
1129	04718	0250	4	55	77	DW8
1236	04738	1125	2	55	77	D53
3624	07729	1430	11	75	86	36
3740	07731	2200	5	75	86	5
0540	07833	3600	1	52	81	202

Apionsoma murinae bilobatae

1254	04516	0625	66	55	77	DR37
1255	04516	0350	2	55	77	DR3#

Apionsoma trichocephalus

1254	04456	0032	5	55	77	S50
1243	04510	0002	2	77	86	1C
1243	04510	0027	1	77	86	2B
1247	04512	0009	3	77	83	A1
1247	04512	0009	2	77	83	A2
1247	04512	0009	7	77	83	A3
1247	04512	0018	2	77	83	B2
1246	04512	0022	15	77	83	D1
1246	04512	0022	12	77	83	D2
1246	04512	0022	7	77	83	D3
1247	04512	0023	1	77	83	G1
1247	04512	0013	74	77	86	A1
1247	04512	0013	31	77	86	A2
1247	04512	0013	61	77	86	A3
1247	04512	0021	1	77	86	G3
1252	04516	0007	1	55	77	S29
1225	04616	0024	3	55	77	S110
1222	04628	0005	15	55	77	S117
2220	16630	0022	2	77	85	16A
2220	16630	0019	5	77	85	19A
2220	16630	0019	32	77	85	19B
2220	16630	0015	1	77	85	38A
2220	16630	0008	3	77	85	47C

Aspidosiphon elegans

2130	05610	0001	1	50	80	31
2130	05610	0001	2	50	80	201
2130	05610	0001	21	50	80	202
2130	05610	0001	1	50	80	203
2130	05610	0001	2	50	80	206

Aspidosiphon gracilis

1243	04510	0002	1	77	86	16
1242	04510	0025	1	77	86	6B
1247	04512	0018	1	77	86	82
2220	16630	0016	3	77	85	29A

Aspidosiphon laevis

2220	16630	0012	1	77	85	28A
2220	16630	0011	3	77	85	63B

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Aspidosiphon muelleri

1254	04454	0750	1	55	77	DB52
1246	04458	0530	19	55	77	DB62
1229	04502	0450	8	55	77	DB71
1231	04502	0325	8	55	77	DB72
1305	04508	0400	3	55	77	DK41
1305	04508	0460	1	55	77	DB42
1242	04510	0025	1	77	86	6A
1242	04510	0025	4	77	86	6B
1242	04510	0025	4	77	86	6C
1242	04510	0027	1	77	86	7B
1242	04510	0027	8	77	86	7C
1247	04512	0018	2	77	83	B2
1246	04512	0022	1	77	83	D1
1246	04512	0020	1	77	86	D3
1247	04512	0021	1	77	86	G2
1247	04512	0009	2	77	83	A3
1238	04512	0675	1	56	77	DK27
1254	04516	0340	4	55	77	DR33
1255	04516	0350	44	55	77	DR38
1254	04516	0500	1	55	77	DR34
1245	04516	0015	16	55	77	S18
1246	04516	0006	8	55	77	S23
1254	04516	0340	1	55	77	833
1252	04516	0030	1	55	77	836
1242	04520	0705	1	55	77	DK28
1222	04628	0005	1	55	77	S117
1132	04716	0515	666	55	77	DS93
1132	04716	0450	81	55	77	DS94
1129	04718	0250	78	55	77	DK8
1125	04719	0026	2	55	77	DS101
1126	04722	0440	28	55	77	DK104
1131	04723	0620	16	55	77	DS122
1132	04723	0024	1	55	77	8124
1130	04724	0361	330	55	77	DS120
1235	04738	1125	1	55	77	DS3
4930	07005	0031	4	42	72	19SHK
3845	07722	0465	1	75	86	28
3846	07729	0315	2	75	86	18
3838	07733	0525	1	75	86	33
3841	07733	0135	2	75	86	35
3753	07737	0575	1	75	86	12
2220	16630	0028	2	77	85	3
2220	16630	0022	1	77	85	16A
2220	16630	0022	2	77	85	16B
2220	16630	0016	3	77	85	29A
2220	16630	0016	1	77	85	29B
2220	16630	0016	2	77	85	29C
2220	16630	0015	2	77	85	38A
2220	16630	0010	1	77	85	58A
2220	16630	0022	16	77	85	67A
2220	16630	0022	14	77	85	67B

Aspidosiphon spiralis

2220	16630	0022	1	77	85	16A
2220	16630	0022	3	77	85	16B
2220	16630	0019	1	77	85	19A
2220	16630	0013	10	77	85	27B
2220	16630	0016	6	77	85	29A
2220	16630	0016	2	77	85	29B
2220	16630	0016	1	77	85	29C
2220	16630	0022	1	77	85	67A

Aspidosiphon steenstrupii

1245	04518	0020	1	55	77	R32
2130	05610	0020	1	50	80	24
2130	05610	0001	1	50	80	25
2130	05610	0001	2	50	80	31
2130	05610	0020	1	50	80	100
2130	05610	0001	1	50	80	102
2130	05610	0001	2	50	80	202
2130	05610	0001	2	50	80	203
2130	05610	0001	2	50	80	212

Aspidosiphon thomassini

1243	04510	0002	5	77	86	1A
1243	04510	0002	1	77	86	1B
1243	04510	0002	2	77	86	1C
1246	04512	0003	1	77	86	E1
1254	04516	0340	5	55	77	S33
2220	16630	0019	1	77	85	19A
2220	16630	0019	2	77	85	19B

Aspidosiphon zinni

3740	07731	2200	4	75	86	5
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Cloeosiphon aspergillus

2130	05610	0030	2	50	80	18
2130	05610	0030	1	50	80	49
2130	05610	0001	1	50	80	201
2130	05610	0001	2	50	80	202

Golfingia margaritacea

4559	03747	0192	2	42	76	BB157
4650	03751	0110	84	42	76	BB168
4552	03752	0031	16	42	76	BB125
4556	03754	0095	109	42	76	BB79
4553	03754	0110	24	42	76	BB97
4650	03756	0138	8	42	76	BB108
4658	03800	0204	10	42	76	BB88
4646	03803	0190	1	42	76	BB111
4617	04937	0275	10	42	76	BB273
4603	04948	0267	12	42	76	BB250
4625	05033	0192	4	42	76	BB291
4837	06831	0125	3	42	75	F52-DC120
4841	06839	0104	1	42	75	F58-DC140
4841	06902	0018	1	42	75	G60-DC141
4841	06902	0017	1	42	75	BB143-G60
4801	06904	0177	1	42	75	G68-DC155
4841	06904	0050	3	42	75	BB148-G61
4922	06909	0140	1	42	75	G64-DC154
4904	06921	0043	23	42	75	BB187-G79
4858	06928	0230	BB	42	75	BB193-G81
4933	06940	0058	5	42	75	BB21-B10
4920	06944	0048	1	42	74	3108MK
4944	06945	0103	1	42	75	BB14-DC36
4930	06946	0025	2	42	72	618MK
4927	06947	0102	3	42	72	538MK
4931	06947	0042	1	42	72	1168MK
4933	06946	0023	2	42	72	1128MK
4910	06952	0071	20	42	74	3258MK
4911	06953	0050	6	42	74	3238MK
4935	06953	0036	1	42	72	928MK

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(S) (E) (M) IND.

4938	06955	0028	2	42	72	96SMK	
4908	06957	0050	11	42	75	BB201-B04	
4935	06958	0045	6	42	72	33SMK	
4931	07000	0025	1	42	72	20SMK	
4934	07000	0020	2	42	72	29SMK	
4935	07000	0023	2	42	72	37SMK	
4935	07000	0033	5	42	72	38SMK	
4855	07000	0106	1	42	75	BB211-B07	
4935	07001	0045	1	42	72	31SMK	
4938	07001	0088	2	42	72	101SMK	
4931	07003	0060	3	42	72	12SMK	
4939	07004	0058	6	42	72	104SMK	
4920	07006	0028	10	42	72	87SMK	
4838	07006	0105	2	42	75	BB216-B09	
4940	07006	0034	1	42	72	106SMK	
4942	07006	0036	1	42	72	107SMK	
4920	07007	0032	2	42	72	73SMK	
4918	07007	0024	1	42	72	74SMK	
4942	07007	0088	1	42	72	108SMK	
4922	07008	0032	6	42	72	80SMK	
4922	07008	0040	1	42	72	81SMK	
4931	07009	0095	1	42	72	148SMK	
4821	07009	0128	10	42	75	BB219/20-B	
4932	07010	0065	2	42	72	135SMK	
4920	07010	0027	5	42	72	85SMK	
4920	07010	0030	6	42	72	144SMK	
4920	07010	0030	5	42	72	149SMK	
4928	07011	0065	2	42	72	38MK	
4930	07011	0020	2	42	72	58MK	
4918	07011	0031	6	42	72	76SMK	
4925	07012	0045	7	42	74	215SMK	
4920	07012	0025	2	42	74	217SMK	
4926	07013	0062	3	42	74	206SMK	
4929	07014	0051	10	42	72	109MK	
4744	07014	0163	1	42	75	B93-CF226	
4926	07014	0060	1	42	74	205SMK	
4922	07014	0022	1	42	74	219SMK	
4918	07015	0032	2	42	74	256SMK	
4928	07016	0044	8	42	72	124SMK	
4927	07018	0040	15	42	72	125SMK	
4926	07018	0044	5	42	72	126SMK	
4930	07019	0042	3	42	72	134SMK	
4934	07019	0027	1	42	72	138SMK	
4929	07022	0044	5	42	75	A2-DC4	
4727	07024	0170	1	42	75	BB230-B96	
4929	07033	0075	1	42	75	A2-DC6	
4903	07041	0076	1	42	75	I108-CF261	

Golfingia muricaudata

4658	03800	0204	11	42	76	BB88	
1231	04502	0325	5	55	77	DS72	
1305	04508	0460	1	55	77	DS42	
1238	04512	0675	10	55	77	DR27	
1144	04735	3716	2	55	77	CR87	
4859	08708	0315	2	42	75	E47-DC108	
4811	08742	0275	1	42	75	BB132-P55	
4858	06928	0230	37	42	75	BB193-G81	
3846	07729	0315	3	75	86	18	
3824	07729	1430	3	75	86	38	
3838	07733	0525	1	75	86	33	
3747	07740	1685	2	75	86	2	
0537	07824	3660	2	52	81	219	

Golfingia pectinatoides

1132	04723	0024	3	55	77	B124	
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Nephasoma constrictum

1255	04516	0350	8	55	77	DR38	
0659	07850	2540	2	52	81	305	
0707	07900	2475	1	52	81	304	
0829	07919	1095	5	52	81	407	
0143	08708	4350	1	52	81	810	

Nephasoma cutleri

4658	03754	0095	14	42	76	BB79	
4650	03756	0138	17	42	76	BB108	
4658	03800	0204	3	42	76	BB88	
1254	04454	0750	1	55	77	DS52	
0537	07824	3660	4	52	81	219	

Nephasoma diaphanes

4659	03747	0192	4	42	76	BB157	
4650	03751	0110	27	42	76	BB160	
4652	03752	0031	24	42	76	BB125	
4656	03754	0095	19	42	74	BB79	
4645	03803	0190	2	42	76	BB111	
1254	04454	0750	2	55	77	DS52	
1248	04457	0700	1	55	77	DS58	
1305	04508	0460	3	55	77	DS42	
1238	04512	0675	2	55	77	DS27	
1254	04516	0340	6	55	77	DR33	
1254	04516	0625	7	55	77	DR40	
1255	04516	0350	17	55	77	DR38	
1256	04518	1390	25	55	77	DR40	
1132	04716	0450	1	55	77	DS94	
1129	04718	0250	3	55	77	DS8	
1144	04730	3700	85	55	77	CR90	
1144	04735	3716	230	55	77	CR87	
4617	04837	0275	16	42	76	BB273	
4600	04958	0215	1	42	76	BB253	
4557	05021	0143	1	42	76	BB236	
4645	05029	1230	10	42	76	BB281	
4625	05033	0190	7	42	76	BB291	
4552	05035	0145	7	42	76	BB218	
4618	05048	0210	6	42	76	BB297	
4619	05130	0375	1	42	76	BB183	
5004	06829	0195	1	42	75	C24-DB58	
4904	06921	0043	1	42	75	BB187-G79	
4951	07020	0145	8	42	75	BB270-J113	
4955	07024	0168	1	42	75	BB273-J114	
3848	07727	0975	2	75	86	20	
3846	07729	0315	6	75	86	18	
3824	07729	1430	5	75	86	36	
3740	07731	2200	16	75	86	5	
3755	07732	0262	4	75	86	15	
3848	07735	0450	1	75	86	21	
3755	07739	1200	1	75	86	13	
0537	07824	3660	1	52	81	0219	
0603	07933	5175	3	52	81	2718	
0143	08706	4420	4	52	81	803	

Onchnesoma magnibathum

3152	04829	3825	1	52	79	1508	
0143	08706	4420	1	52	81	803	

Onchnesoma squamatum

1231	04502	0325	12	55	77	DS72	
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LATIT LONGIT DEPTH NUMA SQBC YR STATION
(S) (E) (M) IND.

Onchnesoma steenstrupii

1248	04457	0700	20	55	77	DS58
1241	04457	0815	3	55	77	DS64
1231	04502	0325	23	55	77	DS72
1228	04512	0675	7	55	77	DS72
1254	04516	0340	4	55	77	DS33
1254	04516	0625	87	55	77	DR37
1255	04516	0350	1	55	77	DS38

Phascolion convestitum

1242	04510	0027	1	77	86	7C
2220	16630	0028	4	77	85	3
2220	16630	0016	2	77	85	29A
2220	16630	0010	1	77	85	48B

Phascolion hybridum

3848	07727	0975	37	75	86	20
3835	07736	0925	9	75	86	34

Phascolion lucifugax

1242	04510	0025	1	77	86	6A
1242	04510	0025	1	77	86	6B
1242	04510	0025	1	77	86	6C
1222	04628	0005	1	55	77	S117

Phascolion lutense

3152	04829	3825	1	52	79	8
3848	07727	0975	9	75	86	20
3824	07729	1430	1	75	86	36
3740	07731	2203	17	75	86	5

Phascolion strombus

1254	04516	0825	17	55	77	DS27
1255	04516	0350	304	55	77	DS38
1256	04518	1390	3	55	77	DS40
1129	04718	0250	2	55	77	DS8
4930	07006	0031	1	42	72	198MX
4648	07030	1218	3	42	75	898-CP243
4653	07033	0920	1	42	75	88241-897
4832	07119	1390	1	42	75	88260-I107

Phascolion tuberosum

1247	04512	0023	2	77	83	G3
1125	04719	0026	29	55	77	DS101
1126	04722	0440	8	55	77	DS104
3846	07729	0915	1	75	86	18
3755	07732	0262	1	75	86	15
2220	16630	0022	1	77	85	16A
2220	16630	0022	4	77	85	16B

Phascolosoma nigrescens

1252	04516	0030	1	55	77	S36
1225	04616	0020	2	55	77	#106
1225	04616	0024	2	55	77	#110
2130	05610	0001	1	50	80	3
2130	05610	0001	1	50	80	25
2130	05610	0001	1	50	80	31
2130	05610	0001	1	50	80	102
2130	05610	0015	1	50	80	103
2130	05610	0001	3	50	80	201
2130	05610	0001	1	50	80	211
2220	16630	0009	1	77	85	208

Phascolosoma noduliferum

3752	07729	0090	4	75	86	7
3747	07734	0075	7	75	86	3

Phascolosoma scolops

1225	04616	0024	1	55	77	S110
1125	04719	0026	4	55	77	DS101
2130	05610	0001	2	50	80	1
2130	05610	0001	1	50	80	5
2130	05610	0001	3	50	80	9
2130	05610	0001	4	50	80	31
2130	05610	0001	3	50	80	102
2130	05610	0001	2	50	80	201
2130	05610	0001	6	50	80	202
2130	05610	0001	3	50	80	203

Phascolosoma stephensoni

2130	05610	0001	1	50	80	1
2130	05610	0001	1	50	80	7

Sipunculus nudus

1254	04458	0032	34	55	77	S50
1254	04458	0015	5	55	77	S51
1242	04459	0038	13	55	77	S65
1304	04509	0033	2	55	77	S46
1237	04510	0018	26	55	77	S24
1246	04516	0006	2	55	77	S23
1254	04516	0340	5	55	77	S33
1252	04516	0030	2	55	77	S36
1252	04516	0007	2	55	77	S39
1226	04616	0024	1	55	77	S111
1222	04624	0020	3	55	77	S15
1222	04628	0013	19	55	77	S116
1222	04628	0005	8	55	77	S117
1132	04723	0024	11	55	77	S124
1130	04723	0007	1	55	77	S8125